

CLAIMS

WHAT IS CLAIMED IS:

1. A damped system for moving a load, comprising:
 - an electric motor having damping means;
 - a mechanical connection between the electric motor and the load;
 - a transducer to sense an indicator related to load force or torque and produce a feedback signal; and
 - a controller connected to the electric motor and providing a motor control signal to move the load to a desired position, and connected to the transducer for receiving the feedback signal and adjusting the motor control signal based on the feedback signal whereby disturbances to the position of the load are damped.
2. The damped system of claim 1, wherein the electric motor is a servo motor comprising an electromagnetic actuator.
3. The damped system of claim 1, wherein the transducer is one of a force transducer, a torque transducer, and an accelerometer.
4. The damped system of claim 1, wherein the transducer is a current sensor.
5. The damped system of claim 3, further comprising a high pass filter which filters the feedback signals.
6. The damped system of claim 1, wherein the electric motor has a stator and a rotor, and wherein a diameter of the stator divided by a diameter of the rotor is set for damping, the ratio being at least 2.75.
7. The damped system of claim 6, wherein the diameter of the stator divided by the diameter of the rotor is at least about five.

8. The damped system of claim 6, wherein the diameter of the stator divided by the diameter of the rotor is at least about ten.

9. The damped system of claim 4, wherein the electric motor has a stator and a rotor, and a diameter of the stator divided by a diameter of the rotor is set for damping to at least 2.75.

10. The damped system of claim 9, wherein the diameter of the stator divided by the diameter of the rotor is at least about five.

11. The damped system of claim 9, wherein the diameter of the stator divided by the diameter of the rotor is at least about ten.

12. The damped system of claim 1, wherein the damping means comprises a resistance and a switch for connecting the motor windings in a short circuit with the resistance in response to loss of power to the motor, whereby oscillating disturbances to the position of the load are damped even when there is no power to the motor.

13. The damped system of claim 12, wherein the resistance comprises two resistors.

14. The damped system of claim 12, wherein the resistance comprises three resistors.

15. The damped system of claim 12, wherein the motor comprises a stator and a rotor, and the feedback means further includes setting the diameter of the stator divided by a diameter of the rotor equal to at least about 2.75.

16. The damped system of claim 15, wherein the diameter of the stator divided by the diameter of the rotor is at least about five.

17. The damped system of claim 15, wherein the diameter of the stator divided by the diameter of the rotor is at least about ten.
18. The damped system of claim 1, wherein the mechanical connection includes a power train which has a gear ratio of at least about fifty.
19. The damped system of claim 1, wherein the load comprises a front wheel of a vehicle.
20. A method of providing damping to disturbances to the position of a load in a load moving system, the method comprising the steps of:
 - moving a load with an electric motor;
 - sensing an indicator of load movement and feeding back a feedback signal indicative of the sensed indicator; and
 - controlling the electric motor by providing a motor control signal to move the load to a desired position based on the feedback signal, whereby disturbances to the position of the load are damped.
21. The method of claim 20, wherein the motor has windings, and the method further comprises a step of providing a resistance, and a step of connecting the motor windings in a short circuit with the resistance in response to loss of power to the motor, whereby disturbances to the position of the load are damped even when there is no power to the motor.
22. A damped system for moving a load, comprising:
 - an electromagnetic actuator;
 - a mechanical connection between the electromagnetic actuator and the load;

a controller connected to the electromagnetic actuator and providing a motor control signal to move the load to a desired position; and

a damping mechanism electrically responsive to an indicator related to force or torque oscillations of the load from the position in response to disturbances to the position of the load.

23. The damped system of claim 22, wherein the damping mechanism comprises a transducer to sense an indicator related to load force or torque oscillations, and produce a feedback signal, and the controller is also connected to the transducer for receiving the feedback signal and adjusting the control signal to the motor based on the feedback signal whereby disturbances to the position of the load are damped.

24. The damped system of claim 22, wherein the electromagnetic actuator comprises an electrical motor having windings, and the damping mechanism comprises a resistance, and a switch for connecting the motor windings in a short circuit with the resistance in response to loss of power to the motor whereby disturbances to the position of the load are damped even when there is no power to the motor.